

CLAIMS

What is claimed is:

1. A solenoid for providing linear actuation, comprising:

a) first and second polepieces having axial bores coaxially disposed along a

5 common axis;

b) an electrical conductor wound around said polepieces in a plurality of turns;

c) an armature slidably disposed in said axial bores;

d) a bearing disposed one of said first and second polepieces; and

e) a shaft attached coaxially to said armature and extending through a supportive
10 bore in said bearing, said shaft being axially displaceable by electromagnetic
displacement of said armature to provide said actuation.

2. A solenoid in accordance with Claim 1 wherein said armature is
separated from said polepieces by a generally cylindrical air gap.

3. A solenoid in accordance with Claim 1 wherein said armature is frusto-
15 conical.

4. A solenoid in accordance with Claim 1 wherein said solenoid is
included in an actuator attachable to a device for providing linear actuation to said
device.

5. A solenoid in accordance with Claim 1 wherein the respective
20 diameters of said bearing bore and said shaft are as nearly identical as is possible
without engendering drag on said shaft.

6. A valve assembly for exhaust gas recirculation between the exhaust manifold and the intake manifold of an internal combustion engine, said assembly including an exhaust gas recirculation valve and further including a solenoid actuator attached to said valve, said solenoid actuator having first and second polepieces having axial bores coaxially disposed along a common axis, an electrical conductor wound around said polepieces in a plurality of turns, an armature slidably disposed in said axial bores, a bearing axially disposed in one of said first and second polepieces, and a shaft attached coaxially to said armature and extending through a supportive bore in said bearing, said shaft being axially displaceable by electromagnetic displacement of said armature to provide actuation of said valve.

7. An internal combustion engine, comprising:

- a) an intake manifold;
- b) an exhaust manifold; and
- c) a valve assembly for exhaust gas recirculation between said exhaust manifold

and said intake manifold, said assembly including an exhaust gas recirculation valve and further including a solenoid actuator attached to said valve and having first and second polepieces having axial bores coaxially disposed along a common axis, an electrical conductor wound around said polepieces in a plurality of turns, an armature slidably disposed in said axial bores, a bearing axially disposed in one of said first and second polepieces, and a shaft attached coaxially to said armature and extending through a supportive bore in said bearing, said shaft being axially displaceable by

electromagnetic displacement of said armature to provide actuation of said valve to admit exhaust gas from said exhaust manifold into said intake manifold.